Atti Soc. it. Sci. nat. Museo civ. Stor. nat. Milano, 145 (II): 251-281, Dicembre 2004

Alessandro Garassino*, Antonio De Angeli**,
Lorenzo M. Gallo*** & Giovanni Pasini****

Brachyuran and anomuran fauna from the Cenozoic of Piedmont (NW Italy)

Abstract - The discovery of decapod crustaceans from the Cenozoic of the Piedmont Region (NW Italy) was until now limited to reports by A. Sismonda (1839), E. Sismonda (1846, 1861), Ristori (1886, 1889), Crema (1895), Allasinaz (1987), Marangon & De Angeli (1997), De Angeli & Marangon (2001, 2003) and Larghi (2003). The recent discovery of brachyurans and anomurans from some localities in Novara, Asti, Alessandria and Biella provinces increases the carcinologic knowledge from the Cenozoic of Italy. The studied specimens are assigned to species already known in other Italian regions and to a new species. The brachyuran specimens include: *Lysirude paronae* (Crema, 1895) (family Raninidae De Haan, 1841), *Calappa granulata* (Linnaeus, 1758) (family Calappidae H. Milne Edwards, 1837), *Ilia pliocaenica* Ristori, 1891a, and *Palaeomyra bispinosa* A. Milne Edwards, 1861 (family Leucosiidae Samouelle, 1819), *Carcinus* sp. and *Liocarcinus* cfr. *L. rakosensis* (Lörenthey & Beurlen, 1929) (family Portunidae Rafinesque, 1815), *Coeloma vigil* A. Milne Edwards, 1865 (family Geryonidae Colosi, 1924), *Eriphia* sp. (family Xanthidae MacLeay, 1838), *Pilumnus* sp. (family Pilumnidae Samouelle, 1819), *Goneplax rhomboides* (Linnaeus, 1758) and *Chlinocephalus demissifrons* Ristori, 1886 (family Goneplacidae MacLeay, 1838). Moreover, two well-preserved carapaces, discovered near Cocconato (Asti), are ascribed to the living genus *Medorippe* Manning & Holthuis, 1981, as *M. ampla* n. sp. (family Dorippidae MacLeay, 1838). It is the second report of this genus in Italy. Some incomplete specimens of anomurans, discovered in Masserano and Cossato localities (Biella), are ascribed to *Pagurus* sp. (family Paguridae Latreille, 1802).

Key words: Crustacea, Decapoda, Cenozoic, Italy.

Riassunto - La fauna a crostacei brachiuri e anomuri del Cenozoico del Piemonte (NO Italia).

La scoperta di crostacei decapodi cenozoici del Piemonte (NO Italia) era finora limitata a segnalazioni da parte di A. Sismonda (1839), E. Sismonda (1846, 1861), Ristori (1886, 1889), Crema (1895), Allasinaz (1987), Marangon & De Angeli (1997), De Angeli & Marangon (2001, 2003) e Larghi (2003). La recente scoperta di brachiuri e anomuri in alcune località, ubicate nelle province di Novara, Asti, Alessandria e Biella incrementa le conoscenze carcinologiche relative al Cenozoico ita-

*Museo Civico di Storia Naturale, Corso Venezia 55, 20121 Milano, Italy, e-mail: a.garassino@tin.it
**Associazione Amici del Museo Zannato, Piazza Marconi 15, 36075 Montecchio Maggiore (Vicenza), Italy, e-mail: antonio_deangeli@virgilio.it
***Museo Regionale di Scienze Naturali, Via Giolitti 36, 10123 Torino, Italy, e-mail: lorenzom.gallo@regione.piemonte.it
****Museo Civico dei Fossili di Besano, Via Prestini 5, 21050 Besano (Varese), Italy, e-mail: museodibesano@tiscali.it

liano. Gli esemplari studiati appartengono a specie già conosciute in altre regioni italiane e ad una nuova specie. I brachiuri comprendono: *Lysirude paronae* (Crema, 1895) (famiglia Raninidae De Haan, 1841), *Calappa granulata* (Linnaeus, 1758) (famiglia Calappidae H. Milne Edwards, 1837), *Ilia pliocaenica* Ristori, 1891a, e *Palaeomyra bispinosa* A. Milne Edwards, 1861 (famiglia Leucosiidae Samouelle, 1819), *Carcinus* sp. e *Liocarcinus* cfr. *L. rakosensis* (Lörenthey & Beurlen, 1929) (famiglia Portunidae Rafinesque, 1815), *Coeloma vigil* A. Milne Edwards, 1865 (famiglia Geryonidae Colosi, 1924), *Eriphia* sp. (famiglia Xanthidae MacLeay, 1838), *Pilumnus* sp. (famiglia Pilumnidae Samouelle, 1819), *Goneplax rhomboides* (Linnaeus, 1758) e *Chlinocephalus demissifrons* Ristori, 1886 (famiglia Goneplacidae MacLeay, 1838). Inoltre, due carapaci ben conservati rinvenuti vicino a Cocconato (Asti), sono ascritti al genere vivente *Medorippe* Manning & Holthuis, 1981, con *M. ampla* n. sp. (famiglia Dorippidae MacLeay, 1838). Si tratta della seconda segnalazione di questo genere in Italia. Alcuni esemplari incompleti di anomuri, rinvenuti a Masserano e Cossato (Biella), sono ascritti a *Pagurus* sp. (famiglia Paguridae Latreille, 1802).

Parole chiave: Crustacea, Decapoda, Cenozoico, Italia.

Introduction

The study of brachyurans and anomurans from the Oligocene, Miocene and Pliocene levels of the Piedmont Region (NW Italy) until now was limited to reports by A. Sismonda (1839), E. Sismonda (1846, 1861), Ristori (1886, 1889), Crema (1895), Allasinaz (1987), Marangon & De Angeli (1997), De Angeli & Marangon (2001, 2003) and Larghi (2003). The recent discovery of brachyurans and anomurans from some localities, such as Cocconato (Asti), Orta San Giulio (Novara), Candelo, Cossato and Masserano (Biella), Morbello-Case Cherpione (Alessandria) (Fig. 1) permitted increase of the carcinologic knowledge about these systematic groups. The studied specimens are assigned to species already known in other Italian regions and to a new species.

Geological setting

Cocconato (Asti)

The outcrop is located inside the chalky sulphur-bearing Formation (Messinian, upper Miocene) cropping out in two narrow zones, elongate east-west for over 100 km along the northern and southern margins of the Tertiary Basin of Piedmont. The studies of the Messinian layers were carried on by Sacco (1888, 1889-1890, 1890-1904, 1922), Sturani & Sampò (1973), Sturani (1978), Fontes *et al.*, (1987), in particular for the Albese area. More restricted are the studies carried on in the Astigiano areas (Jervis, 1889; Boni & Casnedi, 1970; Gallo, 1998; Brambilla & Gallo, 2002) and in the Alessandria province (Balduzzi *et al.*, 1981; Brambilla *et al.*, 1982; Ghibaudo *et al.*, 1985).

The studied specimens come from the chalk quarry, one of the biggest in the Astigiano area, situated in the locality Gessi, between Banego hamlet and Cocconato village. The quarry, worked for over one century, is located in a wide lens of macrocrystalline chalk inside some blocks of more or less clayey chalky marls, grey or whitish-grey in colour, a few millimetres or a few centimetres thick, with flat, slightly corrugated structure. The pelitic deposits in which the studied specimens were discovered are 8-10 m thick, as observed in the southern margin of the quarry.

Fig. 1 - Piedmont Region with fossiliferous localities (Regione Piemonte con le località fossilifere). 1) Candelo; 2) Cossato; 3) Masserano; 4) Orta S. Giulio; 5) Morbello-Case Cherpione; 6) Cocconato.

Orta San Giulio (Novara)

Parona (1886) described some Pliocene layers near Orta Lake, cropping out on the west coast of the lake and around Gozzano village. These layers are usually grey clays, more or less sandy or marly, sometimes with some arenaceous intercalations. The same author reported a discovery by Baretti & Sacco (1885) of an outcrop, located along the road between Gozzano and Miasino, at the base of the Tower of Buccione close to the Cascina della Torre, where well stratified Pliocene sediments crop out in a small area beneath the morainic front. Bivalves and echinoderms are the most common fossils reported in this outcrop.

If the indication reported on the label is correct (Lido d'Orta, path that ascends from the beach to the Torre del Buccione), the studied specimens were discovered in the same layers reported by Baretti & Sacco (1885), if the beach is that located S of the promontory from which the Tower arises.

Cossato (Biella)

The territory of Cossato is composed essentially of Pliocene and Quaternary sediments. Sacco (1888, 1889-1890, 1890-1904, 1922) described some fossiliferous outcrops, cropping up in Val Strona, dating them as Piacentian (*sensu Auctorum*). Aimone & Ferrero Mortara (1983) studied an outcrop located along the left side of Torrente Strona, in the town of Cossato, composed of levels of more or less clayey fine blue-grey sands, rich in fossils, largely molluscs and annelids, but sometimes also cirripeds and decapods.

The studied specimens come from a series of sandy grey beds, located below and west of the cemetery of Cossato, along the state road for Biella. The outcrop, exposed during the construction of the new state road for ValleMosso, is today completely covered by vegetative cover.

Candelo (Biella)

Sacco (1888, 1889-1890, 1890-1904, 1922) studied the outcrops located at the base of the Baraggia di Candelo, while Aimone & Ferrero Mortara (1983) studied a locality cropping out along Torrente Cervo (Bocca del Lupo locality), between Cossato and Candelo villages. The lithographic sequence (4 m thick) shows from the base to the top: thin grey-blue sands, poorly stratified and rich in fossils (transition zone); thin yellow bioturbated sands, scarce in fossils (outer beach); thin yellow sterile sands, well stratified (shoreline environment). The studied specimens come from the outcrop of Bocca di Lupo.

Masserano (Biella)

The Pliocene horizons of Masserano locality are composed of grey siltstone-micaceous sands, more or less compact, with a rich molluscs fauna described by Bellardi (1872-1890), Sacco (1890-1904), Zuffardi Comerci (1929) and Aimone & Ferrero Mortara (1983).

The studied specimens were discovered in an outcrop, reported by Charrier (1957) and Aimone & Ferrero Mortara (1983) located along the rivers of Torrente Osterla, S of Masserano. The outcrop, exposed for over 100 m in length and 4 m in thickness, shows from the basis to the top, fossiliferous coarse sands and grey silty sands alternating with arenaceous levels rich in fossils, particularly bivalves and echinoderms.

Morbello-Case Cherpione (Alessandria)

The studied specimens were discovered in an outcrop located along the municipal road between Piazza (Morbello city) and Ciglione (Ponzone city), about 200 m from Case Cherpione. In this area, well studied by Charrier *et al.* (1964), Allasinaz (1987), Balossino & Bianco (1987), Marangon & De Angeli (1997) and De Angeli & Marangon (2001, 2003), crop out some blue-grey marly levels forming the basal part of the Marne di Rigoroso (Oligocene – Rupelian/Chattian) in

contact with the sediments of the Formazione di Molare (Rupelian). Allasinaz (1987) reported the frequent discovery of pebbles and oval-shape nodules in which complete and incomplete decapods are often preserved.

Previous studies of the decapod crustaceans from the Cenozoic of Piedmont

Oligocene

The studies of the decapod fauna from the Rupelian (lower Oligocene) of Bacino Ligure-Piemontese were carried on by Ristori (1886, 1889), Allasinaz (1987), Marangon & De Angeli (1997), De Angeli & Marangon (2001, 2003) and Larghi (2003). The studied species are: *Hoploparia* sp., *Callianassa canavari* Ristori, 1889, *Callianassa* sp., *Pagurus* sp., *Zygopa galantensis* (De Angeli & Marangon, 2001), *Ranina speciosa* (Münster, 1840), *Lophoranina aldrovandii* (Ranzani, 1820), *Calappa* sp., *Calappilia mainii* Allasinaz, 1987, *C. vicentina* Fabiani, 1910, *C. verrucosa* A. Milne Edwards, 1873, *Mursiopsis postulosus* Ristori, 1889, *Cherpiocarcinus rostratus* Marangon & De Angeli, 1997, *Palaeocarpilius macrochelus* (Desmarest, 1822), *Portunus convexus* (Ristori, 1889), *Coeloma vigil* A. Milne Edwards, 1865, and *Retropluma* sp.

Miocene-Pliocene

The first study of decapod crustaceans from Piedmont Region was conducted by A. Sismonda (1839) who described *Cancer punctulatus* Desmarest, 1822 (= *Lobocarcinus sismondae* (v. Meyer, 1843)), based on two specimens from Santo Stefano Roero (Cuneo).

E. Sismonda (1846) reported *Platycarcinus antiquus* Sismonda, 1846 (= *Lobocarcinus sismondae* (v. Meyer, 1843)), *Xantho edwardsi* Sismonda, 1846, and *Ranina palmea* Sismonda, 1846, from the hills around Asti and Torino. Later, E. Sismonda (1861) reported *Palaeomyra bispinosa* A. Milne Edwards, 1861, *Ranina Aldrovandi* Ranzani, 1820 (= *Lophoranina aldrovandii* (Ranzani, 1820)), *Platycarcinus Sismondae* Meyer, 1843 (= *Lobocarcinus sismodae* (v. Meyer, 1843)), *Portunus Edwardsi* Sismonda, 1861 (= *Xantho edwardsi* E. Sismonda, 1846), *Pagurus substriatus* A. Milne Edwards, 1861, and *Callianassa Sismondae* A. Milne Edwards, 1860, from the same localities.

Ristori (1886) reported *Cancer Sismondae* v. Meyer, 1843 (= *Lobocarcinus sismondae* (v. Meyer, 1843)), from the localities of Quaglina around Asti, Santo Stefano Roero, Verrua Savoia and Monte Capriolo close to Bra, and *Titanocarcinus Edwardsii* (E. Sismonda, 1846) (= *Xantho edwardsi* E. Sismonda, 1846) from the Pliocene marls near Asti.

The last study of decapod crustaceans was conducted by Crema (1895) who reported *Calappa*? sp. from the Astian (= Piacentian *sensu* Cita *et al.*, 1996 in Monegatti & Raffi, 1996) (middle Pliocene) of Pino d'Asti and *Goneplax Sacci* Crema, 1895 (= *Goneplax gulderi* Bachmayer, 1953) from the Pliocene with Piacentian facies of Monte Capriolo close to Bra, *Portunus* sp. from the Pliocene (Piacentian *Auctorum*) of Villavernia, *Goneplax*? *Craverii* Crema, 1895 (today *Retropluma craverii* (Crema, 1895)), *Titanocarcinus Edwardsii* (E. Sismonda, 1846) (= *Xantho edwardsi* E. Sismonda, 1846), and *Cancer Sismondae* v. Meyer, 1843 (= *Lobocarcinus sismondae* (v. Meyer, 1843)) from the Pliocene (Piacentian *Auctorum*) of Bra.

Material

The studied sample consists of 49 complete and fragmentary specimens, from the Oligocene, Miocene and Pliocene levels of Cocconato, Orta San Giulio, Candelo, Cossato, Masserano, Morbello-Case Cherpione. Most of the studied specimens are three-dimensionally preserved and their preparation is easy due to the soft consistency of the surrounding rock. The study of the sample (property of Museo di Geologia e Paleontologia dell'Università di Torino and housed in Museo Regionale di Scienze Naturali di Torino and Museo Civico di Storia Naturale di Milano), permitted identification of the following species: *Pagurus* sp. (4 specimens), *Lysirude paronae* (Crema, 1895) (1 specimen), *Medorippe ampla* n. sp. (2 specimens), *Calappa granulata* (Linnaeus, 1758) (14 specimens), *Ilia pliocaenica* Ristori, 1891a (6 specimens), *Palaeomyra bispinosa* A. Milne Edwards, 1861 (6 specimens), *Carcinus* sp. (4 specimens), *Liocarcinus* cfr. *L. rakosensis* (Lörenthey & Beurlen, 1929) (1 specimen), *Coeloma vigil* A. Milne Edwards, 1865 (3 specimens), *Eriphia* sp. (3 specimens), ?*Pilumnus* sp. (2 specimens), *Goneplax rhomboides* (Linnaeus, 1758) (2 specimens) and *Chlinocephalus demissifrons* Ristori, 1886 (1 specimen).

The systematic palaeontology used in this paper follows the recent classification proposed by Martin & Davis (2001).

Acronym. PU: Paleontologia Università di Torino; MSNM: Museo Civico di Storia Naturale di Milano.

Systematic Palaeontology

Infraorder Anomura MacLeay, 1838
Superfamily Paguroidea Latreille, 1802
Family Paguridae Latreille, 1802
Genus *Pagurus* Fabricius, 1775

Type-species: *Cancer bernhardus* Linnaeus, 1758

Pagurus sp.
Fig. 2 a-c

Geological age: Pliocene.

Occurrence and measurements: we assign four dactyli to this genus. PU 41144 (Masserano – Biella), PU 41145, PU 41146, PU 41147 (Cossato – Biella). Length of the dactyli between 0.9 and 25 mm.

Description. Dactyli have subtriangular shape, short and convex, curved upper margin with rounded or spiny tubercles and deep pits, concave lower margin (distal margin) with small teeth joined each other, outer margin with occasional granulations and occlusal margin with wide and flat teeth.

Discussion. The studied specimens can be compared with *Pagurus squamosus* Ristori, 1886, from the Pliocene of Sarteano (Siena – Tuscany) (Ristori, 1886 – Pl. 3, Figs. 3-5).

Fig. 2 - *Pagurus* sp., n. cat. PU 41145; a) outer margin (margine esterno); b) inner margin (margine interno); c) occludent margin (margine occludente) (x 3.5).

Infraorder Brachyura Latreille, 1802
Section Eubrachyura de Saint Laurent, 1980
Superfamily Raninoidea De Haan, 1841
Family Raninidae De Haan, 1841
Subfamily Lyreidinae Guinot, 1993
Genus *Lysirude* Goeke, 1985

Type-species: *Raninoides nitidus* A. Milne Edwards, 1880

Lysirude paronae (Crema, 1895)
Figs. 3, 4

1895 *Lyreidus paronae* Crema; p. 671, Fig. 11
1907 *Lyreidus paronae* Crema in Sacco; p. 116
1998 *Lysirude paronae* (Crema) in Tucker; p. 324

Geological age: Pliocene.

Occurrence and measurements: we assign to this species one well-preserved specimen. PU 41148 (Orta San Giulio – Novara). Body length, 39.5 mm. The holotype studied by Crema (1895) is today housed in Museo Regionale di Scienze Naturali di Torino (n. cat. PU 80111).

Discussion. This species was described on the basis of the morphological characters of two carapaces, from the Helvetian (Miocene) of Sciolze and from the Langhian (Miocene) of S. Margherita (Turin hills) respectively. The studied specimen, coming from the Pliocene levels of Orta San Giulio, preserves the carapace partially. The specimen, larger than the holotype, has a narrow anterior margin, elongate and protruding triangular rostrum, a pair of small supraorbital spine, one extraorbital spine as long as the rostrum, divergent anterolateral margin slightly convex in the middle, spine of the anterolateral angle protruded forwards obliquely. The dorsal surface of the carapace is slightly tuberculate, primarily in the postfrontal and hepatic regions.

Crema (1895) ascribed this species to *Lyreidus* De Haan, 1841. Recently, Tucker (1998) ascribed this species to *Lysirude* Goecke, 1985, based upon the presence of the rostrum, elongate extraorbital spines and curve anterolateral margins. *Lysirude* includes three living species, *L. nitidus* (A. Milne Edwards, 1880), *L. channeri* (Wood-Mason, 1885) and *L. griffini* (Goecke, 1985), widespread in Atlantic and Indo-Pacific Oceans, and four fossil species, *L. hookeri* (Feldmann, 1992) from the lower and upper Eocene of Antarctic Peninsula, *L. hungaricus* (Beurlen, 1939) from the Oligocene of Hungary, *L. paronae* (Crema, 1895) from the Miocene and Pliocene of Italy, and *L. waitakiensis* (Glaessner, 1980) from the middle Eocene of New Zealand.

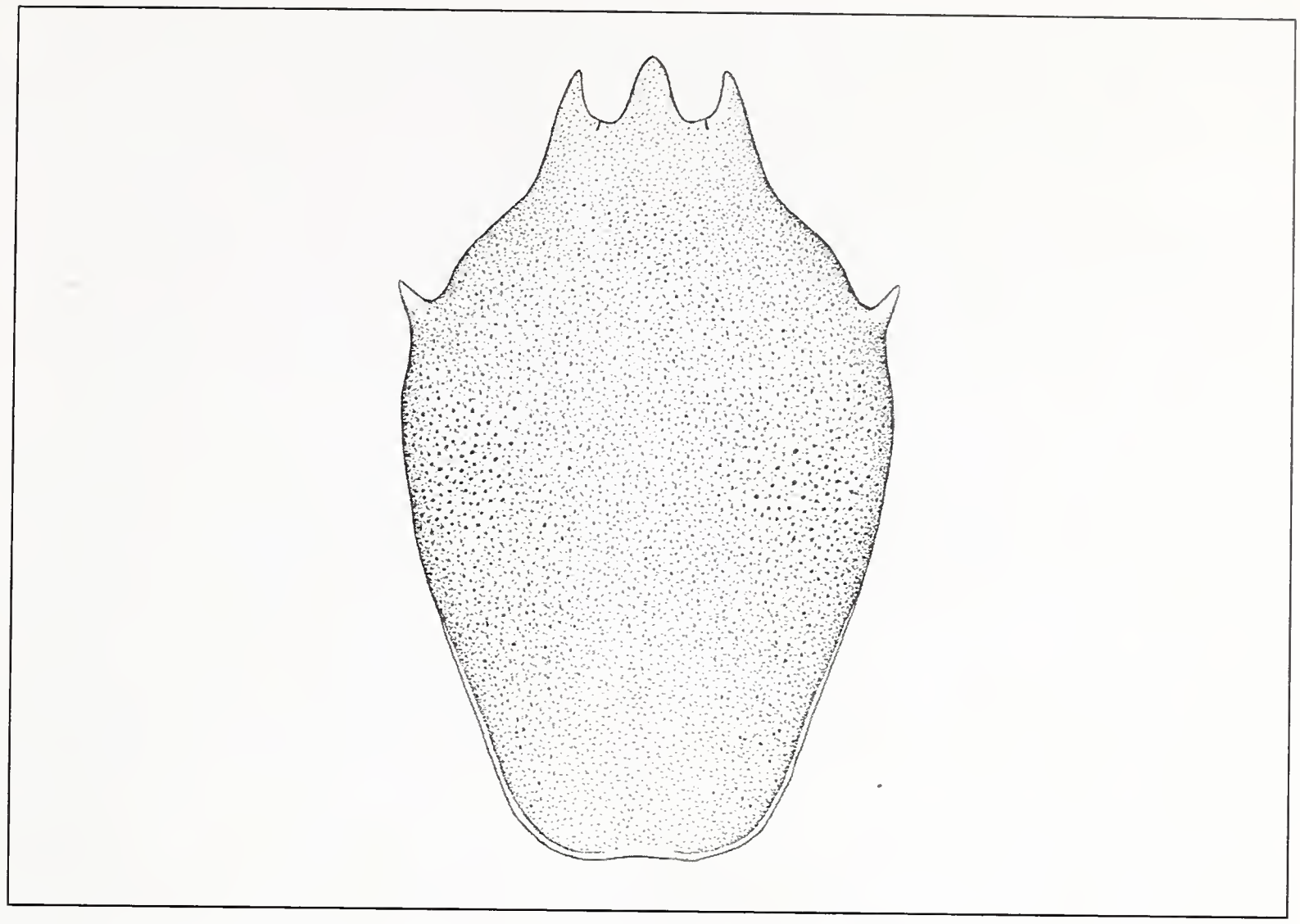

Fig. 3 - *Lysirude paronae* (Crema, 1895), reconstruction of the species (ricostruzione della specie).

Fig. 4 - *Lysirude paronae* (Crema, 1895), n. cat. PU 41148 (x 1.5).

Subsection Heterotremata Guinot, 1977
Superfamily Dorippoidea MacLeay, 1838
Family Dorippidae MacLeay, 1838
Subfamily Dorippinae MacLeay, 1838

Discussion. Larghi (2004) discussed the family Dorippidae MacLeay, 1838, including three subfamilies: Dorippinae MacLeay, 1838 (fossil and living), Ethusinae Guinot, 1977 (fossil and living) and Telamonocarcininae Larghi, 2004 (fossil).

The subfamily Dorippinae was discussed by Houlthuis & Manning (1990) who reported nine living genera (*Dorippe* Weber, 1795, *Dorippoides* Serène & Romimohtarto, 1969, *Heikea* Holthuis & Manning, 1990, *Medorippe* Manning & Holthuis, 1981, *Neodorippe* Serène & Romimohtarto, 1969, *Nobilum* Serène & Romimohtarto, 1969, *Paradorippe* Serène & Romimohtarto, 1969, *Philippidorippe* Chen, 1985, *Phyllodorippe* Manning & Holthuis, 1981) and one fossil genus, *Titanodorippe* Blow & Manning, 1996, from the Eocene of the United States.

Karasawa (2000) provided a check list of the fossil species of this subfamily: *Dorippe fankhauuseri* Studer, 1892, from the middle Miocene of Switzerland, *D. tuberculata* Morris & Collins, 1991, from the Pliocene of Brunei, *D. quadridens* (Fabricius, 1793) from the Holocene of unknown locality; *Dorippoides facchio* (Herbst, 1785) from the Pliocene of Java; *Heikea japonica* (Von Siebold, 1824) from the Holocene of Japan; *Medorippe lanata* (Linnaeus, 1767) from the Pleistocene of Italy; *M. margaretha* (Lörenthey in Lörenthey & Beurlen, 1929) from the middle Miocene of Hungary and Portugal; *M. tanabei* Karasawa, 2000, from the middle Miocene of Japan; *Neodorippe*? *carpathica* (Förster, 1979) from the middle Miocene of Poland; *Nobilum wenchi* Hu & Tao, 1996, from the Miocene of Taiwan; *Paradorippe granulata* (De Haan, 1841) from the Pleistocene-Holocene of Japan; *Titanodorippe eocenica* Blow & Manning, 1996, from the upper Eocene of United States.

Goniochele Bell, 1858, and *Orithopsis* Carter, 1872, ascribed to the subfamily Dorippinae by Glaessner (1969), were included in the family Calappidae H. Milne Edwards, 1837, by Wright & Collins (1972).

Genus *Medorippe* Manning & Holthuis, 1981

Type-species: *Cancer lanatus* Linnaeus, 1767

Medorippe ampla n. sp.
Figs. 5, 6 a-b

Diagnosis: subhexagonal carapace, weakly convex, wider than long; wide orbito-frontal margin; bilobate front; wide orbits marked by a well developed

extraorbital tooth; divergent anterolateral margins with an epibranchial spine; elongate posterolateral margins; well marked regions with granulations; deep cervical and cardiac grooves; narrow cardiac region previously with Y-shaped granulate carina; hepatic and branchial regions with granulate carinae.

Etymology: the trivial name takes its origin from the latin word *amplus, a, um* = wide, for the width of carapace.

Holotype: PU 41149.

Paratype: PU 41197.

Type locality: Cocconato (Asti).

Geological age: Messinian (upper Miocene).

Occurrence and measurements: we assign to this new species two well-preserved carapaces in dorsal view with partially preserved front and posterior margin of carapace. PU 41149, PU 41197 (Cocconato – Asti).

Maximum width of carapace: 20.6 mm

Width of orbito-frontal margin: 9.1 mm

Maximum length of carapace: > 14.6 mm

Description. Subhexagonal carapace, weakly convex in both sections, wider than long (length/width of carapace > 0.71). Wide orbito-frontal margin (orbito-frontal length/width carapace = 0.44). Narrow front with two short lobes. Wide orbits with a narrow and short supraorbital fissure. Well developed and elongate extraorbital tooth. Divergent anterolateral margins. Lateral angle with a sharp epibranchial spine protruded antero-laterally. Posterolateral and posterior margins protruded downwards. Dorsal regions well marked by grooves. Deep cervical groove joining branchial grooves laterally. Deep and sinuous branchial grooves joining groove dividing urogastric region from cardiac. Frontal region with a median longitudinal groove. Mesogastric region with narrow and elongate granulate anterior process. Wide, raised protogastric regions with a curved granulate protuberance anteriorly and a strong median tubercle. Suboval granulate urogastric region, raised transversely. Narrow cardiac region anteriorly with Y-shaped granulate carina. Well developed hepatic regions with a granulate carina extending transversely on margin of cervical groove, continuing longitudinally to extraorbital tooth. This granulate carina also extends onto margin of extraorbital tooth, continuing on margin of protogastric region. Another carina arises posterior to inner orbital angle. Well developed branchial region with strong branchial lobe located at margins of cardiac region and transverse granulate carina extending toward lateral margin and anterior mesobranchial region. Dorsal ornamentation of carapace with granulations homogenous more or less and usually situated on carinae and regions. Ventral parts and pereiopods not preserved.

Discussion. The studied specimens have the shape of carapace typical of the subfamily Dorippinae MacLeay, 1838, and close relationships with *Dorippe*, *Phyllodorippe* and *Medorippe* on the basis of a epibranchial lateral spine.

The morphological characters observed in the studied specimens suggest

assignment to *Medorippe* since *Dorippe* has serrate anterolateral margins and distinct dorsal tubercles, while *Phyllodorippe* has cardiac region without Y-shaped carina.

The morphological characters of *M. ampla* n. sp. are similar to those of the type-species *M. lanata* (Linnaeus, 1767), discovered in the Pleistocene of Sicily (Gemmellaro, 1914), and today widespread in the Eastern Atlantic, from the Mediterranean Sea and South-West Africa. However, the type-species differs from *M. ampla* n. sp. for the narrower carapace, longer anterolateral margins and absence of granulate carinae on hepatic, branchial and supraorbital regions.

Other fossil species, such as *M. margaretha* (Lörenthey in Lörenthey & Beurlen, 1929) from the middle Miocene of Hungary and *M. tanabei* Karasawa, 2000, from the middle Miocene of Japan, have narrower and longer carapaces with dorsal ornamentation formed of granulations and tubercles.

Medorippe ampla n. sp. differs from the known representatives of the subfamily Dorippinae in exhibiting a wide carapace and having granulate carinae on hepatic, branchial and supraorbital regions. However, the lack of the anterior part of carapace, of ventral and abdominal parts do not allow a more complete deepening of this species.

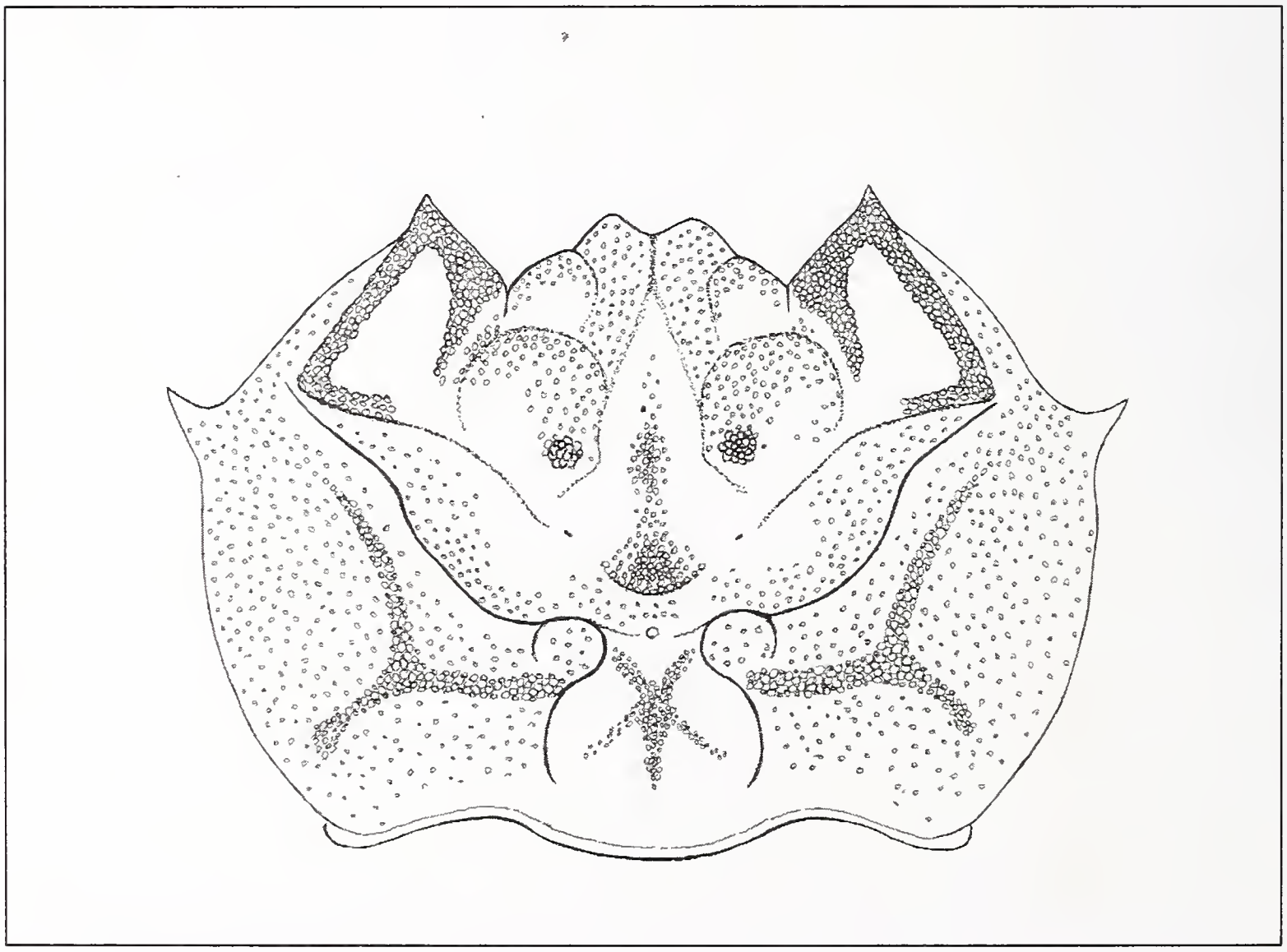

Fig. 5 - *Medorippe ampla* n. sp., reconstruction of the species (ricostruzione della specie).

Fig. 6 - *Medorippe ampla* n. sp.; a) holotype (olotipo), n. cat. PU 41149 (x 2.5); b) paratype (paratipo), n. cat. PU 41147 (x 2.5).

Superfamily Calappoidea H. Milne Edwards, 1837
Family Calappidae H. Milne Edwards, 1837
Genus *Calappa* Weber, 1795

Type-species: *Cancer granulatus* Linnaeus, 1758

Calappa granulata (Linnaeus, 1758)
Fig. 7 a-c

1758 *Cancer granulatus* Linnaeus; p. 627
1767 *Cancer granulatus* Linnaeus; p. 563
1798 *Calappa granulata* (Linnaeus) in Fabricius; p. 346
1816 *Calappa granulata* (Linnaeus) in Risso; p. 18
1825 *Calappa granulata* (Linnaeus) in Desmarest; p. 109, Pl. 10 (Fig. 1)
1828 *Calappa granulata* (Linnaeus) in Roux; Pl. 2 (Fig. 13), Pl. 16 (Figs. 1-7)
1863 *Calappa granulata* (Linnaeus) in Heller; p. 130, Pl. 4 (Fig. 3)
1891 *Calappa* sp. Ristori; p. 9, Pl. 1 (Figs. 10, 15)
1914 *Calappa granulata* (Linnaeus) in Gemmellaro; p. 80, Pl. 1 (Figs. 9-10)
1918 *Calappa granulata* (Linnaeus) in Pesta; p. 308, Text-fig. 97
1936 *Calappa granulata* (Linnaeus) in Nobre; p. 81, Pl. 28 (Figs. 73-74)
1940 *Calappa granulata* (Linnaeus) in Bouvier; p. 203, Text-fig. 203, Pl. 7 (Fig. 1)
1946 *Calappa granulata* (Linnaeus) in Zariquiey Alvarez; p. 143, Text-fig. 163
1965 *Calappa granulata* (Linnaeus) in Forest; p. 362
1968 *Calappa granulata* (Linnaeus) in Zariquiey Alvarez; p. 315, Text-figs. 105c, 107a
1992 *Calappa granulata* (Linnaeus) in Falciai & Minervini; p. 181, Pl. 12 (Fig. 4)
2004 *Calappa granulata* (Linnaeus) in Garassino & De Angeli; p. 38, Fig. 4 (1-3)

Geological age: Pliocene.

Occurrence: we assign to this species 14 fragmentary chelae. PU 41150, PU 41151 (Candelo – Biella), PU 41152, PU 41153, Pu 41156 (Masserano – Biella), PU 41154, PU 41155, PU 41157, PU 41158, PU 41159, PU 41160, PU 41161, PU 41162, PU 41163 (Cossato – Biella).

Discussion. We assign to this species one propodus, one left index, six left dactyli, four right dactyli and two left dactyli with the typical shape of the representatives of the family Calappidae. Propodus is flat and short, as long as wide, without the upper margin and with short teeth. Lower margin bears a longitudinal row of small-sized granulations. Some granulations are also present along the outer margin of propodus. Dactyli are curved and longer than the propodus, with granulations along the upper margin and a strong prominence on the basis of the outer margin.

The studied specimens, even though incomplete, show some morphological affinities with *Calappa granulata* (Linnaeus, 1758).

Calappa sp. described by Ristori (1891a) on two dactyli from the Pliocene of Orciano (Pisa) and *Calappa granulata* (Linnaeus, 1758) described by Gemmellaro (1914) on two dactyli from the Pliocene of Altavilla (Palermo) and from the Pleistocene of Monte Pellegrino (Palermo) have the same morphological characters of the studied specimens. Recently, Garassino & De Angeli (2004) reported the presence of this species from the lower Pliocene/lower-middle Pleistocene of Arda River (Castell'Arquato – Piacenza).

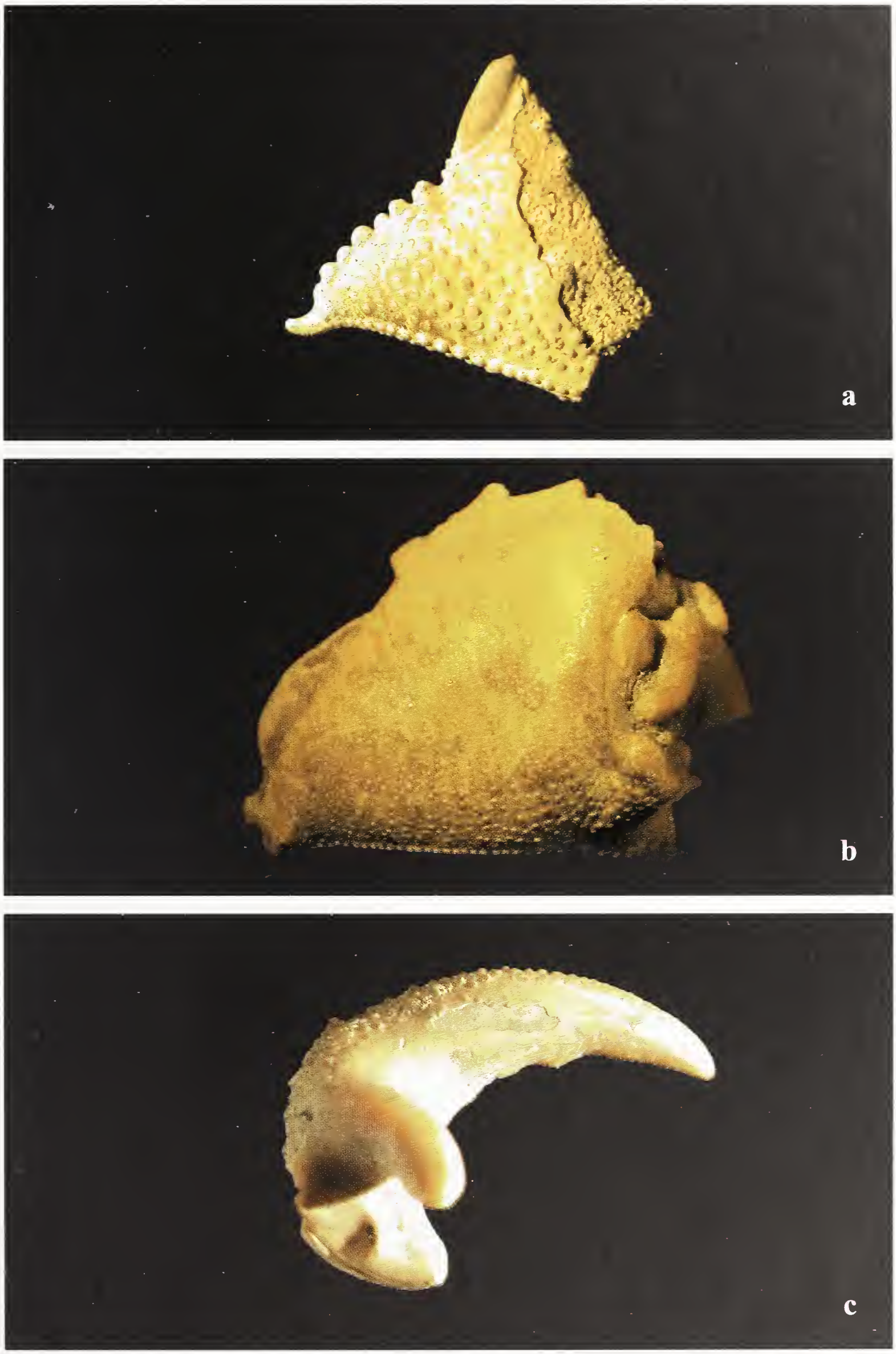

Fig. 7 – *Calappa granulata* (Linnaeus, 1758); a) n. cat. PU 41150, left fixed finger (dito fisso sinistro) (x 3.5); b) n. cat. PU 41156, right palm (propodus destro) (x 2.5); c) n. cat. PU 41158, right dactylus (dactylus destro) (x 4).

Fig. 8 - *Ilia pliocaenica* Ristori, 1891; a) n. cat. PU 41165, merus (x 2.5); b) n. cat. PU 41169, dactylus (x

Superfamily Leucosioidea Samouelle, 1819
Family Leucosiidae Samouelle, 1819
Genus *Ilia* Leach, 1817

Type-species: *Cancer nucleus* Linnaeus, 1758

Ilia pliocaenica Ristori, 1891a
Fig. 8 a-b

1891a *Ilia pliocaenica* Ristori; p. 10, Pl. 1 (Figs. 8, 9, 11, 12, 14)
2004 *Ilia pliocaenica* Ristori in Garassino & De Angeli; p. 40, Fig. 4 (5)

Geological age: Pliocene.

Occurrence: we assign to this species one merus and five dactyli of pereiopod I. PU 41164, PU 41165 (Masserano – Biella), PU 41166, PU 41167, PU 41168, PU 41169 (Cossato – Biella).

Description. Elongate merus of pereiopod I with rich granulations. Elongate dactyli with smooth inner margin.

Discussion. The studied merus is comparable to that illustrated by Ristori (1891a, Pl. 1 – Fig. 14) for *Ilia pliocaenica* Ristori, 1891a, from the Pliocene of Spicchio (Empoli – Tuscany).

Recently, Garassino & De Angeli (2004) reported also this species from the Pliocene of Arda River (Castell'Arquato – Piacenza). *Ilia* Leach, 1817, is widespread in the Mediterranean Sea with the living species *I. nucleus* Linnaeus, 1758.

Genus *Palaeomyra* A. Milne Edwards *in* E. Sismonda, 1861

Type-species: *Palaeomyra bispinosa* A. Milne Edwards *in* E. Sismonda, 1861

Palaeomyra bispinosa A. Milne Edwards *in* E. Sismonda, 1861
Figs. 9, 10 a-b

1861 *Palaeomyra bispinosa* A. Milne Edwards in E. Sismonda; p. 16, Figs. 18-20
1969 *Palaeomyra bispinosa* A. Milne Edwards in Glaessner; p. R498

Geological age: Oligocene (Morbello – Alessandria), Miocene (Cocconato – Asti).
Occurrence: we assign to this species six well-preserved specimens. PU 41170, PU 41171, PU 41172, PU 41173, PU 41174 (Cocconato – Asti), PU 41175 (Morbello – Alessandria).
Discussion. *Palaeomyra* was described by A. Milne Edwards *in* E. Sismonda, 1861, on morphological characters of *P. bispinosa* A. Milne Edwards *in* E. Sismonda, 1861, represented by a fragmentary specimen lacking the frontal margin and discovered in the Miocene sandstone of the hills around Turin.

The recent discovery of some complete and well-preserved carapaces allowed to identify, for the first time, the main morphological characters of this species: subglobular shape of the dorsal surface of the carapace, anterior branchial regions more developed than the posterior ones, deep gastro-branchial groove, suboval and rounded cardiac region, postero-lateral angles with two elongate spines and dorsal surface of carapace with irregular tubercles, stronger in the branchial and cardiac regions. The dorsal surface of carapace has irregular tubercles, particularly abundant in the posterior and median parts of carapace. We pointed out that the dorsal tuberculation is usually variable in the studied specimens. In fact, some specimens have bigger tubercles in metagastric, urogastric, cardiac and branchial regions, while others have tubercles sometimes located in longitudinal rows in metagastric and urogastric regions.

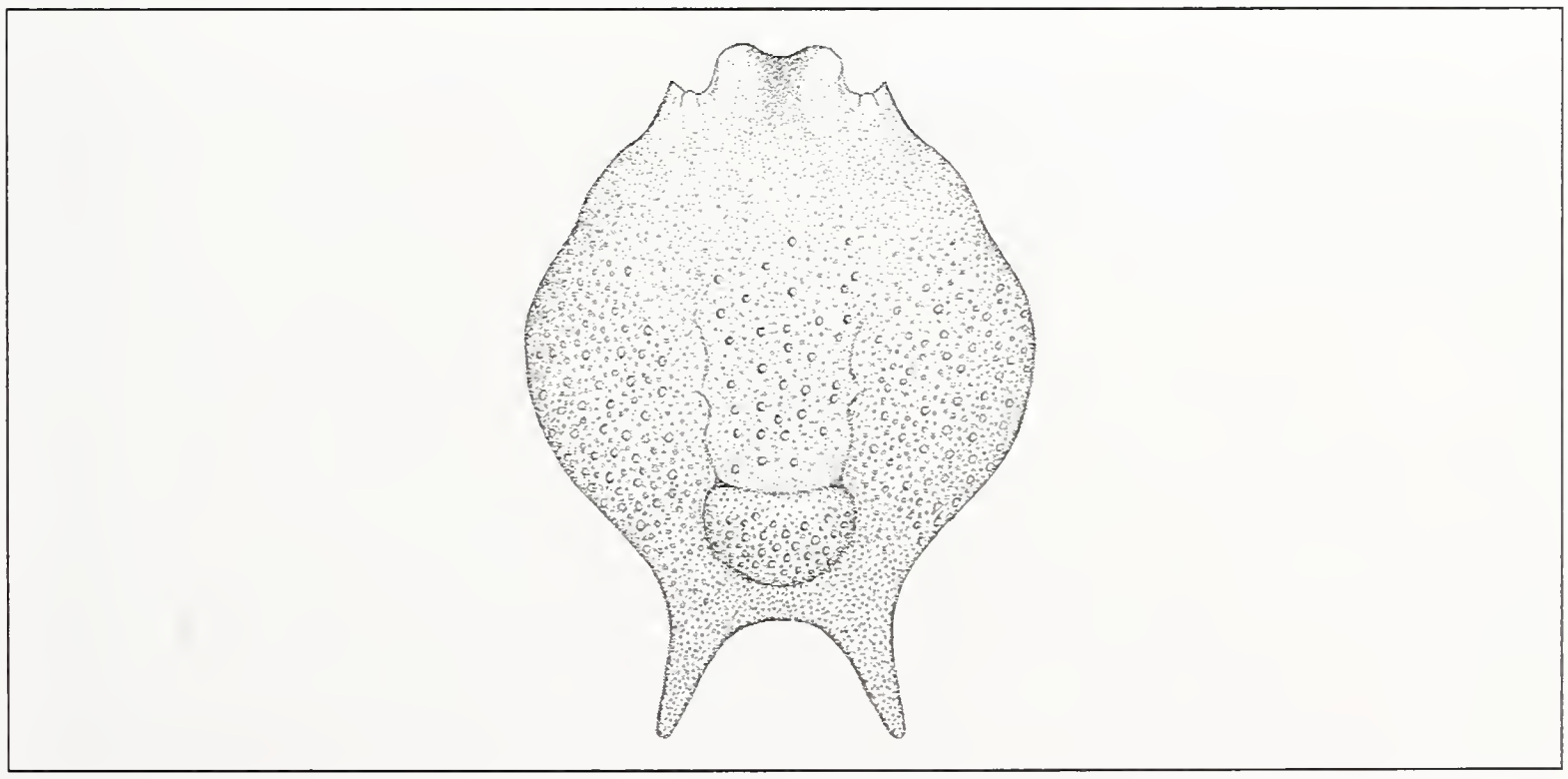

Fig. 9 - *Palaeomyra bispinosa* A. Milne Edwards *in* E. Sismonda, 1861, reconstruction of the species (ricostruzione della specie).

Glaessner (1969) included *Palaeomyra* in the check list of the infraorder Brachyura, without giving a dignosis. Müller (1984) ascribed *Ebalia globulosa* Müller, 1976, to *Palaeomyra*.

The studied specimens preserve the carapace with the morphological characters described by A. Milne Edwards. The front is wide and bilobate, the orbits are small and rounded, the spines located in the postero-lateral angles are variable in sizes, the posterior margin is elongate and convex and the dorsal surface of the carapace shows irregular tubercles.

E. Sismonda (1861) compared *Palaeomyra* A. Milne Edwards *in* E. Sismonda, 1861, with the living species *Myra fugax* Leach. Morphological affinities in the shape of carapace and in the presence of elongate spines of the postero-lateral angles are also with *Pseudomyra mbizi* Capart, 1951, widespread along the West African coasts, even though the living species does not show the gastro-branchial grooves.

Fig. 10 - *Palaeomyra bispinosa* A. Milne Edwards *in* E. Sismonda, 1861; a) n. cat. PU 41171 (x 2.5); b) n. cat. PU 41174 (x 3).

Superfamily Portunoidea Rafinesque, 1815
Family Portunidae Rafinesque, 1815
Subfamily Carcininae MacLeay, 1838
Genus *Carcinus* Leach, 1814

Type-species: *Cancer maenas* Linnaeus, 1758

Carcinus sp.

Geological age: Pliocene.

Occurrence: we assign to this genus four complete dactyli. PU 41176, PU 41177, PU 41178, PU 41179 (Cossato – Biella).

Description. Dactyli are strong, elongate and curved, and with short teeth on the occlusal margin.

Discussion. This kind of dactylus is present in *Carcinus* Leach, 1814, widespread in the Mediterranean Sea and Atlantic Ocean as two living species, *C. maenas* (Linnaeus, 1758) and *C. aestuarii* Nardo, 1847.

Genus *Liocarcinus* Stimpson, 1871

Type-species: *Portunus holsatus* Fabricius, 1798

Liocarcinus cfr. *L. rakosensis* (Lörenthey & Beurlen, 1929)
Fig. 11

Geological age: Miocene.

Occurrence: we compare this incomplete carapace in dorsal view to *L. rakosensis* (Lörenthey & Beurlen, 1929). PU 41198 (Cocconato – Asti).

Discussion. Even though the studied specimen is incomplete, some morphological characters, such as the carapace with marked regions and serrate lateral margins, allowed to ascribe it to *Liocarcinus* Stimpson, 1871.

Morphological affinities are evident with *L. rakosensis* (Lörenthey & Beurlen, 1929) from the Miocene of Hungary (Müller, 1984). In fact the Italian and Hungarian specimens show well-marked dorsal regions of carapace with wide cardiac region and rounded margins. However, the studied specimen shows a more fine granulation on the regions of carapace respect the Hungarian species.

Only the future discovery of most complete specimens will allow a morphological description and a sure systematic ascription of this sample, limited today to a report.

Liocarcinus Stimpson, 1871, is widespread in the Mediterranean Sea as ten living species (Falciai & Minervini, 1992).

Fig. 11 – *Liocarcinus* cfr. *L. rakosensis* (Lörenthey & Beurlen, 1929), n. cat. PU 41198 (x 2.5).

Family Geryonidae Colosi, 1924
Genus *Coeloma* A. Milne Edwards, 1865

Type-species: *Coeloma vigil* A. Milne Edwards, 1865

Coeloma (*Coeloma*) *vigil* A. Milne Edwards, 1865

1861 *Cancer beggiatoi* Michelotti; p. 140, Pl. 14 (Figs. 1-2)
1865 *Coeloma vigil* A. Milne Edwards; p. 352, Pl. 35 (Figs. 1-3)
1875 *Coeloma vigil* A. Milne Edwards in Bittner; p. 97, Pl. 5 (Figs. 1-4)
1883 *Coeloma vigil* A. Milne Edwards in Bittner; p. 314
1889 *Coeloma vigil* A. Milne Edwards in Ristori; p. 403, Pl. 15 (Figs. 4-5)
1901 *Coeloma vigil* A. Milne Edwards in Oppenheim; p. 283
1910 *Coeloma vigil* A. Milne Edwards in Fabiani; p. 33
1929 *Coeloma vigil* A. Milne Edwards in Glaessner; p. 122

1929 *Coeloma vigil* A. Milne Edwards in Lörenthey & Beurlen; p. 243, Pl. 15 (Fig. 16)
1969 *Coeloma* (*Coeloma*) *vigil* A. Milne Edwards in Glaessner; R524, Fig. 332(2a)
1987 *Coeloma* (*Coeloma*) *vigil* A. Milne Edwards in Allasinaz; p. 542, Text-figs. 1-4, Pl. 7 (Figs. 1-5)
2001 *Coeloma* (*Coeloma*) *vigil* A. Milne Edwards in De Angeli & Beschin; p. 29, Fig. 24

Geological age: Oligocene.

Occurrence: we assign to this species three well-preserved carapaces: two in dorsal view, MSNM i26279, MSNM i26280 (Case Cherpione – Alessandria), and one in ventral view, MSNM i26281 (Case Cherpione – Alessandria).

Discussion. *Coeloma* (*Coeloma*) *vigil* A. Milne Edwards, 1865, was already described from the upper Eocene and Oligocene of N Italy and Hungary.

C. (*Coeloma*) *vigil* is frequent in the levels from the Rupelian (lower Oligocene) of Bacino Ligure Piemontese where it was reported in Sassello and Santa Giustina localities by Ristori (1889), and Ciglione, Ponzone, Montanino di Rio Caramagna, Rio Volpina and Case Cherpione by Allasinaz (1987). The specimen of *Cancer beggiatoi* (= *C.* (*Coeloma*) *vigil*) reported from the lower Miocene by Michelotti (1861) must to be ascribed to the Oligocene (Allasinaz, 1987).

Other decapods reported from the same levels are: *Hoploparia* sp., *Callianassa canavari* Ristori, 1889, *Callianassa* sp., *Pagurus* sp., *Zygopa galatensis* (De Angeli & Marangon, 2001), *Ranina speciosa* (Münster, 1840), *Lophoranina aldrovandii*? (Ranzani, 1820), *Calappa* sp., *Calappilia mainii* Allasinaz, 1987, *C. vicentina* Fabiani, 1910, *C. verrucosa* A. Milne Edwards, 1873, *Mursiopsis postulosus* Ristori, 1889, *Cherpiocarcinus rostratus* Marangon & De Angeli, 1997, *Palaeocarpilius macrochelus* (Desmarest, 1822), *Portunus convexus* (Ristori, 1889) and *Retropluma* sp. (Ristori, 1886; 1889; Allasinaz, 1987; Marangon & De Angeli, 1997; De Angeli & Marangon, 2001, 2003; Larghi, 2003).

The decapods of these outcrops are very important to deepen the carcinologic knowledge of brachyurans from the Oligocene, known to date in Italy only from the Oligocene outcrops of Vicenza province.

Superfamily Xanthoidea MacLeay, 1838
Family Xanthidae MacLeay, 1838
Genus *Eriphia* Latreille, 1817

Type-species: *Cancer spinifrons* Herbst, 1785

Eriphia sp.
Fig. 12 a-b

Geological age: Pliocene.

Occurrence: we assign to this genus one complete chela, PU 41180 (Orta San Giulio – Novara) and two complete dactyli of chela of pereiopod I, PU 41181 (Masserano – Biella), PU 41182 (Cossato – Biella).

Fig. 12 - *Eriphia* sp.; a) n. cat. PU 41180 (x 1.2); b) n. cat. PU 41181 (x 1.2).

Description. Subcylindrical propodus, longer than high, with upper margin slightly convex strengthened by four elongate and sharp spines. Lower margin convex. Outer margin slightly granulate. Elongate fixed finger with serrate occlusal margin. Strong dactylus slightly curved with two longitudinal grooves along the outer margin. Occlusal margin of dactylus with one proximal strong and elongate rounded tooth slightly located outward, five small rounded teeth and two small subtriangular teeth in medium and distal parts.

Discussion. The chela and the dactyli show morphological characters typical of the genera belonging to the superfamily Xanthoidea, in particularly with the representatives of *Eriphia* Latreille, 1817. The occlusal margin with a strong proximal

tooth is typical of some specimens ascribed to *Eriphia* sp. from the Miocene of Poland (Förster, 1979) and one dactylus of *E. spinifrons* from the Pleistocene of Sicily (Gemmellaro, 1914).

Some morphological affinities correspond also to those of *E. cocchii* Ristori, 1886, reported from the Pliocene clays of Montrappoli (Val d'Era – Tuscany) and Montebicchieri (S. Miniato – Tuscany). However, the palm of this species has shorter spines also along the upper outer margin. Moreover, the occlusal margin of dactylus has not only a strong rounded tooth, but also a laminar margin with small teeth. Fucini (1910) reported that *E. punctulata* described by Ristori (1886), from the Pliocene clays of Montrappoli must to be considered as synonym of *E. cocchii*.

Family Pilumnidae Samouelle, 1819
Genus *Pilumnus* Leach, 1815

Type-species: *Cancer hirtellus* Linnaeus, 1761

?*Pilumnus* sp.
Fig. 13

Geological age: Pliocene.

Occurrence: we assign in dubitative form to this genus two complete dactyli of pereiopod I. PU 41183, PU 41184 (Cossato – Biella).

Description. Elongate dactyli slightly curved longitudinally and occlusal margin with a strong rounded tooth and a row of small rounded teeth (15 at all) decreasing toward the distal margin. Rounded dactylus in section with smooth surface and capillary orifices.

Discussion. The shape of the studied dactyli resembles that of the living genus *Pilumnus* Leach, 1815, widespread in the Mediterranean Sea with *P. inermis* A. Milne Edwards, 1894, *P. spinifer* H. Milne Edwards, 1834, *P. villosissimus* (Rafinesque, 1814), *P. hirtellus* (Linnaeus, 1761) and *P. aestuarii* Nardo, 1869.

Fig. 13 - ? *Pilumnus* sp., n. cat. PU 41184 (x 4.5).

Family Goneplacidae MacLeay, 1838
Subfamily Goneplacinae MacLeay, 1838
Genus *Goneplax* Leach, 1814

Type-species: *Cancer rhomboides* Linnaeus, 1758

Goneplax rhomboides (Linnaeus, 1758)
Fig. 14

1758 *Cancer rhomboides* Linnaeus; p. 626
1814 *Goneplax angulata* (Bell) in Leach; p. 430
1822 *Goneplax impressa* Desmarest; p. 102, Pl. 8 (Figs. 13-14)
1861 *Goneplax rhomboides* (Linnaeus) in A. Milne Edwards; p. 88
1863 *Gonoplax angulata* (Bell) in Heller; p. 103
1863 *Gonoplax rhomboides* (Linnaeus) in Heller; p. 104, Pl. 3 (Figs. 3-4)
1891b *Gonoplax bispinosa* Leach in Ristori; p. 20
1914 *Gonoplax* cfr. *rhomboides* Gemmellaro; p. 90, Pl. 1 (Fig. 26)
1936 *Goneplax angulata* (Bell) in Nobre; p. 57, Pl. 21 (Fig. 40)
1940 *Goneplax angulata* (Bell) in Bouvier; p. 278, Text-fig. 176, Pl. 9 (Fig. 2)
1946 *Goneplax angulata* (Bell) in Zariquiey Alvarez; p. 162, Pl. 18 (Figs. a-b)
1958 *Goneplax rhomboides* (Linnaeus) in Holthuis & Gottlieb; p. 99
1959 *Goneplax rhomboides* (Linnaeus) in Zariquiey Alvarez; p. 5
1961 *Goneplax rhomboides* (Linnaeus) in Holthuis; p. 57
1968 *Goneplax rhomboides* (Linnaeus) in Zariquiey Alvarez; p. 414, Text-fig. 138 a, b
1992 *Goneplax rhomboides* (Linnaeus) in Falciai & Minervini; p. 238, Pl. 17 (Fig. 1)
2004 *Goneplax rhomboides* (Linnaeus) in Garassino & De Angeli; p. 44, Figs. 12-15

Geological age: Miocene (Cocconato – Asti), Pliocene (Cossato – Biella).

Occurrence and measurements: we assign to this species two well-preserved specimens in dorsal view. PU 41185 (Cocconato – Asti), PU 41186 (Cossato – Biella).

Description. Subrectangular carapace, convex longitudinally, with maximum width anteriorly. Straight front, extended beyond the orbits. Well-developed orbits. Sinuous and elongate supraorbital margin. Well-developed extraorbital spine. Lateral margins slightly concave to the small antero-lateral spine and after convergent until the posterior margin. Wide posterior margin slightly concave in the median part. Dorsal regions not marked. Smooth dorsal surface. Weak transverse relief between the antero-lateral spines. Branchiocardiac groove not marked. Branchial regions with a weak sinuous transverse depression.

Discussion. The morphological characters of the studied specimens are those of the living species *Goneplax rhomboides* (Linnaeus, 1758), widespread in the E Atlantic, N Africa and Mediterranean Sea.

The carapace of *G. rhomboides* is extremely variable and it was interpreted by some authors incorrectly. Desmarest (1822) described and illustrated *G. impressa* based upon some specimens from the Pliocene of Monte Mario (Roma); Ristori (1891b) reported an almost complete carapace from the Pliocene of Monte Mario, ascribing it to *G. bispinosa* Leach, 1816 (*G. bispinosa* is a junior subject of *G.*

rhomboides); A. Milne Edwards (1861) reported the presence of *G. rhomboides* from the Pleistocene of Palermo; Gemmellaro (1914) confirmed the report of Milne Edwards and ascribed to *G.* cfr. *rhomboides* a right dactylus from the Pleistocene marls of Ficarazzi (Palermo). Recently, Garassino & De Angeli (2004) reported the presence of *G. rhomboides* from the Pliocene and Pleistocene of Arda, Enza and Stirone Rivers (Piacenza, Parma and Reggio Emilia provinces).

As reported by Müller (1993), the two species *G. formosa* Ristori, 1886, and *G. meneghinii* Ristori, 1886, from the Pliocene marls of Rapolano (Siena – Tuscany) could probably be ascribed to *G. rhomboides*. Moreover, Müller (1993) pointed out that *Goneplax sacci* Crema, 1895, from the Piacentian (*Auctorum*) of Monte Capriolo near Bra (Torino) and *G.* cfr. *sacci* described by Lörenthey (1907, 1909) from the Miocene of Sardinia are synonyms of *G. gulderi* Bachmayer, 1953. Finally, Beschin *et al.* (1996) pointed out that *Goneplax craverii* Crema, 1895, from the Pliocene (Piacentian *Auctorum*) of Bra should be included in *Retropluma* Gill, 1894.

Fig. 14 - *Goneplax rhomboides* (Linnaeus, 1758), n. cat. PU 41186 (x 3).

Subfamily Euryplacinae Stimpson, 1871
Genus *Chlinocephalus* Ristori, 1886

Type-species: *Chlinocephalus demissifrons* Ristori, 1886

Chlinocephalus demissifrons Ristori, 1886
Figs. 15-16

1886 *Chlinocephalus demissifrons* Ristori; p. 101, Pl. 2 (Figs. 5-6)

Geological age: Pliocene.

Occurrence and measurements: we assign to this species one well-preserved specimen in dorsal view. PU 41187 (Cossato – Biella).

Carapace length: 23.2 mm
Carapace width: 26.6 mm
Fronto-orbital width: 19.2 mm
Frontal width: 9.2 mm

Ristori (1886) described this species on a complete carapace, lacking pereiopods. The good state of preservation of the studied specimen, preserving pereiopods and some morphological characters of carapace not visible on the original sample, allowed an expansion of the original morphological description.

Description. Suboval carapace convex transversally and longitudinally, longer than wide (length/width = 0.87 mm). Well developed fronto-orbital margin (width fronto-orbital/carapace width = 0.72 mm). Wide front (frontal width/fronto-orbital width = 0.47) extended over the orbits with straight margin having a weak median incision. In frontal view this margin has a longitudinal groove forming a double margin. Wide and deep orbits, oriented slightly obliquely and marked by a narrow incision at the inner orbital corner. Raised supraorbital areas. Supraorbital margin concave and interrupted by two short and narrow fissures and marked by a short extraorbital subtriangular tooth at the extremities. Short and divergent anterolateral margins, slightly sinuous, with two sharp spines: the first located on hepatic margin, close to the extraorbital tooth, the second located on epibranchial margin, connecting to the first transverse carina of carapace. Posterolateral margin convex most strongly in the median-posterior part. Wide and straight posterior margin, strengthened by weak carina. Dorsal regions not distinct. Lowered frontal and hepatic regions. One transverse carina arises from the second anterolateral spine, crossing the anterior median part of carapace. Carapace with a transverse depression located behind this carina. A second carina crosses cardiac region, reaching metabranchial regions and curving forward on posterolateral margins. Urogastric and cardiac regions marked by a weak branchiocardiac grooves. Short and wide urogastric region, weakly raised. Suboval and wide cardiac region. Intestinal region depressed. Smooth dorsal surface of carapace. Well developed pereiopod I. Subcylindrical merus with a strong spine on outer margin. Subcircular carpus with a strong spine on inner distal margin. Subcylindrical propodus, longer than wide, more developed in anterior part, with slightly convex upper margin and almost straight lower margin. Elongate fixed finger with a groove on outer margin and four strong teeth on occlusal margin. Elongate, curved dactylus with four strong teeth on occlusal margin.

Discussion. Ristori (1886) described *Chlinocephalus demissifrons* on the basis of the morphological characters of one carapace from the Pliocene sandstone of Fornaci close Savona (Liguria – N Italy). The original specimen is larger than the studied specimen (width = 45 mm; length = 40 mm; length/width = 0.88 mm) and it also preserves the ventral parts and the abdomen. Ristori (1886) described the lateral margins of carapace as sinuous and lacking of spines. Probably, the poor state of preservation of lateral and anterior margins is the reason of the lack of these spines (Ristori, 1886 – Pl. 2, Figs. 5, 6).

Ristori (1886) compared *Chlinocephalus* with *Titanocarcinus* A. Milne Edwards, 1863, and *Plagiolophus* Bell, 1858 (today *Glyphithyreus* Reuss, 1859) and Glaessner (1969) included *Chlinocephalus* into the family Xanthidae.

However, the shape of carapace of *Chlinocephalus* shows more morphological affinities with the representatives of the family Goneplacidae than to family Xanthidae. In fact, Karasawa & Kato (2003), included *Chlinocephalus* in the subfamily Euryplacinae (family Goneplacidae). Close morphological affinities are observable between *Chlinocephalus* and the living genus *Eucrate* De Haan, 1835, both having a frontal margin with a longitudinal groove. The presence of transverse

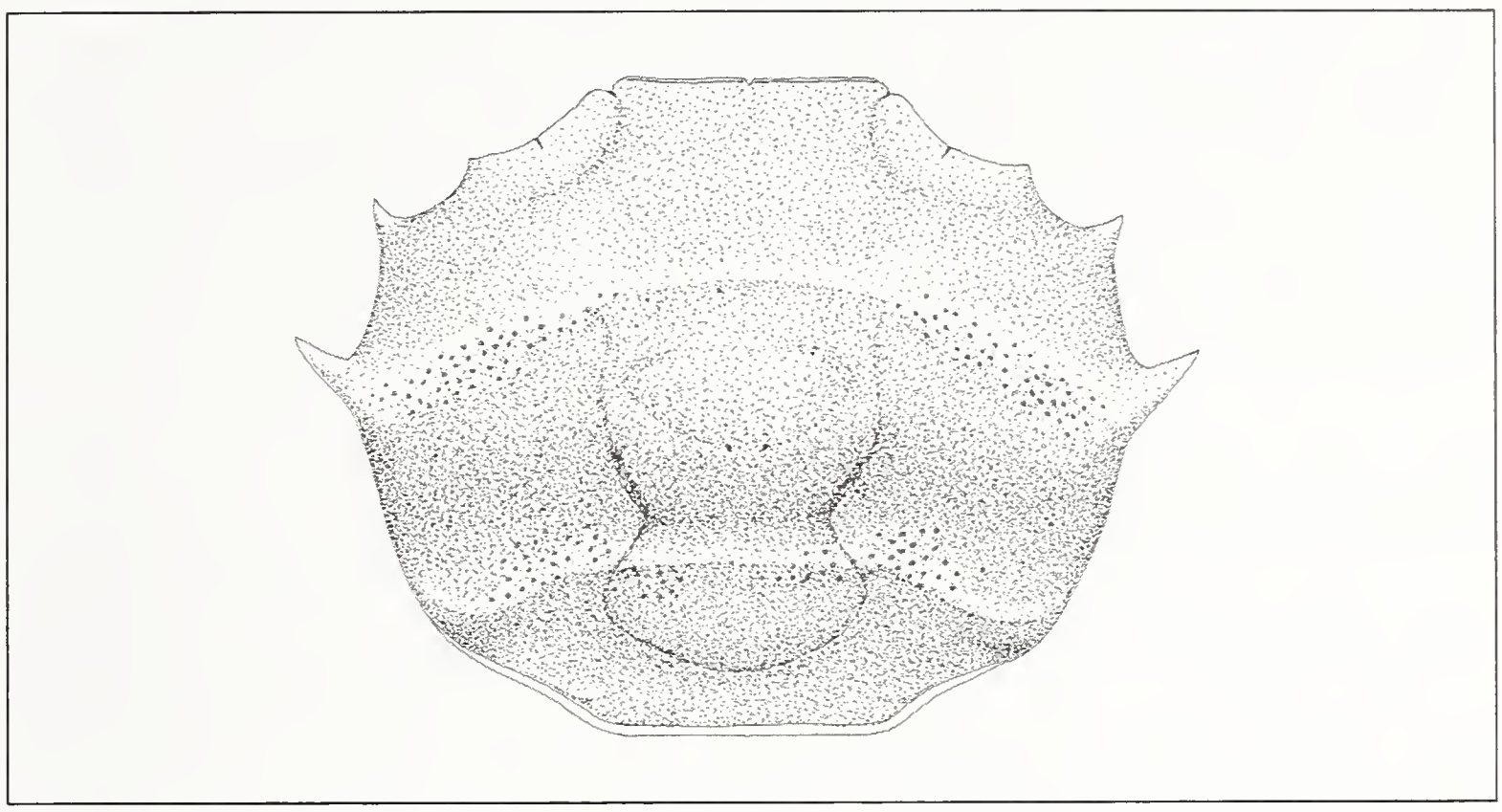

Fig. 15 - *Chlinocephalus demissifrons* Ristori, 1886, reconstruction of the species (ricostruzione della specie).

Fig. 16 - *Chlinocephalus demissifrons* Ristori, 1886, n. cat. PU 41187 (x 1.5).

carinae on the carapace resembles also some fossil species, such as *Carinocarcinus zitteli* Lörenthey, 1898, from the middle Eocene of Germany, *Bicarinocarcinus collinsi* Glaessner & Secretan, 1987, from the Eocene of Pakistan, *B. tumidus* Collins *et al.*, 2003, from the Miocene of Borneo, *Carinocarcinoides carinatus* Karasawa & Fudouji, 2000, and *C. angustifrons* (Karasawa, 1993) from the lower Oligocene of Japan (Lörenthey, 1898; Glaessner & Secretan, 1987; Karasawa, 1993; Karasawa & Fudouji, 2000; Collins *et al.*, 2003).

Finally, we point out that the assignment of *Titanocarcinus sculptus* Ristori, 1891, from the Pliocene clays of Mucigliani (Siena – Tuscany) to *Titanocarcinus* A. Milne Edwards, 1863, is uncertain. In fact, the shape of the front, the size and location of the orbits, the presence of two spines besides the extraorbital spine on anterolateral margins, and the transverse relief on the cardiac region are present also in *Chlinocephalus demissifrons*. The specimen of *T. sculptus* studied by Ristori (1891) could be a juvenile stage (maximum width of carapace = 2 mm; maximum length of carapace = 1.5 mm) of *Chlinocephalus demissifrons*.

Acknowledgements

We wish to thank D. Ormezzano, Museo Regionale di Scienze Naturali, Torino, for giving us the opportunity to study the sample, the Group "Glycimeris" (Serravalle Sesia - Vercelli) for the useful information about the studied outcrops and R. M. Feldmann, Geology Department, Kent State University (Ohio), for the careful review of the manuscript.

References

Aimone S. & Ferrero Mortara E., 1983 – Malacofaune plioceniche di Cossato e Candelo (Biellese, Italia NW). *Bollettino Museo regionale Scienze naturali*, Torino, 1 (2): 279-328.

Allasinaz A., 1987 – Brachiura Decapoda oligocenici (Rupeliano) del Bacino Ligure Piemontese. *Bollettino Museo regionale Scienze naturali*, Torino, 5 (2): 509-566.

Balduzzi A., Brambilla G. & Vittadini Zorzoli M., 1981 – Il paesaggio vegetale del Messiniano di Carbonara Scrivia. *Atti Istituto Geologico Università Pavia*, Pavia, 29: 3-12.

Balossino P. & Bianco P., 1987 – Nota preliminare sulla biostratigrafia dell'area di Ponzone, Cimaferle e Bandita (Piemonte SE). *Bollettino Museo regionale Scienze naturali*, Torino, 4 (2): 469-481.

Baretti M. & Sacco F., 1885 – Il Mergozzolo. C.A.I., Torino.

Bellardi L., 1872-1890 – I Molluschi dei terreni terziari del Piemonte e della Liguria. *Memorie Reale Accademia Scienze Torino*, Torino, 1-6.

Beschin C., Busulini A., De Angeli A. & Tessier G., 1996 – Retroplumoidea (Crustacea, Brachyura) nel Terziario del Vicentino (Italia settentrionale). *Lavori Società Veneziana Scienze Naturali*, Venezia, 21: 83-102.

Boni A. & Casnedi R., 1970 – Note illustrative della Carta Geologica d'Italia. Fogli 69 e 70-Asti, Alessandria. *Poligrafica & Cartevalori*, Ercolano.

Brambilla G., Ronchetti G. & Vittadini Zorzoli M., 1982 – Semi e filliti delle argille messiniane (Miocene superiore) di Carbonara Scrivia (Alessandria). *Atti Istituto Botanico e Laboratorio Crittografico Pavia*, Pavia, ser. 7, 1: 31-40.

Brambilla G. & Gallo L. M., 2002 – Analisi stratigrafica e paleobotanica della successione messiniana di Bric Santa Margherita (Nizza Monferrato, Asti, Italia NW). *Bollettino Museo regionale Scienze naturali*, Torino, 19 (1): 191-283.

Charrier G., 1957 – Fauna pliocenica di San Gaudenzio (Lessona, presso Biella). Nota 2: Foraminiferi, Molluschi Pteropodi. *Bollettino Servizio Geologico Italiano*, Roma, 79: 355-371.

Charrier G, Fernandez D. & Malaroda R., 1964 – La Formazione di Pianfolco (Bacino Oligocenico Ligure-Piemontese). *Atti Accademia Nazionale Lincei*, Roma, ser. 8, 7 (2): 25-82.

Cita M. B., Rio D., Hilgen F., Castradori D., Lourens L. & Vergerio P. P., 1996 – Proposal of the global boundary stratotype section and point (GSSP) of the Piacenzian stage (Middle Pliocene). *International Union Geological Sciences*, S.N.S.: 1-26.

Collins J.S.H., Lee C. & Noad J., 2003 – Miocene and Pleistocene crabs (Crustacea, Decapoda) from Sabah and Sarawak. *Journal of Systematic Palaeontology*, London, 1(3): 187-226.

Crema C., 1895 – Sopra alcuni decapodi terziari del Piemonte. *Atti Reale Accademia Scienze Torino*, Torino, 30: 5-22.

De Angeli A. & Marangon S., 2001 – *Paralbunea galantensis*, nuova specie di anomuro oligocenico del Bacino Ligure-Piemontese (Italia settentrionale). *Studi Trentini Scienze Naturali*, *Acta Geologica*, Trento, 76: 99-105.

De Angeli A. & Marangon S., 2003 – Contributo alla conoscenza dei Decapodi oligocenici del Bacino Ligure Piemontese (Italia settentrionale). *Atti Società italiana Scienze naturali Museo civico Storia naturale Milano*, Milano, 144 (2): 185-196.

Desmarest A.G., 1822 – Histoire Naturelle des Crustacés fossils. Les Crustacés proprement dits. Paris.

Falciai L & Minervini R., 1992 – Guida dei Crostacei Decapodi d'Europa. *F. Muzzio Editore*, Padova.

Fontes J. C., Filly A. & Gaudant J., 1987 – Conditions de dépôt du Messinien évaporitique des environs d'Alba (Piémont): arguments paléontologiques et isotopiques. *Bollettino Società Paleontologica Italiana*, Modena, 26 (1-2): 199-210.

Förster R., 1979 – Decapod crustaceans from the Middle Miocene (Badenian) deposists of Southern Poland. *Acta Geologica Polonica*, Warsaw, 29 (1): 89-106.

Fucini A., 1910 – L'*Eriphia cocchii* Rist. *Annali Università Toscana*, Firenze, 30: 1-5.

Gallo L. M., 1998 – Note geologiche sui dintorni di Nizza Monferrato e Canelli. III. Il Messiniano. *Quaderni dell'Arca*, Nizza Monferrato, 10: 3-37.

Garassino A. & De Angeli A., 2004 – Decapod crustacean fauna from the Pliocene and Pleistocene of Arda, Stirone, and Enza Rivers (Piacenza, Parma, and Reggio Emilia Provinces, N Italy). *Atti Società italiana Scienze naturali Museo civico Storia naturale Milano*, Milano, 145 (1): 29-57.

Gemmellaro M., 1914 – Crostacei e pesci fossili del "Piano Siciliano" dei dintorni di Palermo. *Giornale di Scienze Naturali ed Economiche di Palermo*, Palermo, 30: 73-113.

Ghibaudo G., Clari P. & Perello M., 1985 – Litostratigrafia, sedimentologia ed evoluzione tettonico-sedimentaria dei depositi miocenici del margine sud-orientale del Bacino Terziario ligure-piemontese (Valli Borbera, Scrivia e Lemme). *Bollettino Società Geologica Italiana*, Roma, 104: 349-397.

Glaessner M.F., 1969 – Crustacea Decapoda. In Moore R.C., *Treatise on Invertebrate Paleontology*. Arthropoda 4 (2), Lawrence: R399-R533, R626.

Glaessner M.F. & Secretan S., 1987 – Crabes (Crustacea, Brachyura) de l'Eocène du Salaiman Range (Pakistan). *Annales de Paleontologie (Vert. – Invert.)*, Paris, 73: 273-288.

Jervis G., 1889 – I tesori sotterranei dell'Italia. Parte IV. Geologia Economica dell'Italia. *Loescher*, Torino.

Holthuis L.B. & Manning R.B., 1990 – Crabs of the subfamily Dorippinae MacLeay, 1838, from the Indo-West Pacific region (Crustacea: Decapoda: Dorippidae). *Researches on Crustacea*, Tokyo, special number, 3: 1-151.

Karasawa H., 1993 – Cenozoic Decapod Crustacea from Southwest Japan. *Bulletin Mizunami Fossil Museum*, Mizunami, 20 (1): 1-92.

Karasawa H., 2000 – *Medorippe tanabei*, a new species of Miocene dorippid crab (Crustacea: Decapoda: Brachyura) from the Katsuta Group, West Honshu, Japan. *Proceedings Biological Society Washington*, Washington, 113 (3): 810-814.

Karasawa H. & Fudouji Y., 2000 – Paleogene decapod Crustacea from the Kishima and Okinoshima Groups, Kyushu, Japan. *Palaeontological Research*, Tokyo, 4 (4): 239-253.

Karasawa H. & Kato H., 2003 – The family Goneplacidae MacLeay, 1838 (Crustacea: Decapoda: Brachyura) systematics, phylogeny, and fossil record. *Palaeontological Research*, Tokyo, 7 (2): 129-151.

Larghi C., 2003 – First record of Oligocene retroplumid crab (Crustacea: Decapoda: Brachyura) from Italy. *Bulletin Mizunami Fossil Museum*, Mizunami, 30: 57-60.

Larghi C., 2004 – Brachyuran decapod crustaceans from the Cenomanian (Upper Cretaceous) of Lebanon. *Journal of Paleontology*, Lawrence, 78 (3): 528-541.

Lörenthey I.E., 1898 – Beiträge zur Decapodenfaune des ungarischen Tertiärs. *Mathematisch-Naturwissenschaftliche Berichte des Ungarn*, Budapest, 14: 22-115.

Lörenthey I.E., 1907 – Adatok Sardínia harmadidöszaki rák-faunájához. *Mathematische Es Természettudomanyi Közlemenyek*, Budapest, 19 (2): 243-296.

Lörenthey I.E., 1909 – Beiträge zur tertiärer Decapodenfauna Sardiniens. *Mathematische naturwissenschaftliche Berichte aus Ungarn*, Budapest, 24: 202-259.

Lörenthey I.E. & Beurlen K., 1929 – Die Fossilen Dekapoden der Länder der unghariachen Krone. *Geologica Hungarica*, *Series Palaeontologica*, Budapest, 3: 1-420.

Marangon S. & De Angeli A., 1997 – *Cherpiocarcinus*, nuovo genere di brachiuro (Decapoda) dell'Oligocene del Bacino ligure-piemontese (Italia settentrionale). *Lavori Società Veneziana Scienze Naturali*, Venezia, 22: 97-106.

Martin J.W. & Davis G. E., 2001 – An Updated Classification of the Recent Crustacea. *Natural History Museum of Los Angeles County*, Science series, Los Angeles, 39: 1-124.

Michelotti G., 1861 – Etudes sur le Miocene inférieur de l'Italie septentrionale. *Mémoire Société Hollandais Science*, Harlem, 183: 1-16.

Milne Edwards A., 1861 – Remarques sur la faune carcinologique des terrains quaternaries. *L'Institut, Journal des Sciences et des Societés savants en France*, Paris.

Monegatti P. & Raffi S., 1996 – Castell'Arquato e i suoi dintorni: la culla degli studi sul Pliocene. ATTI XIII, *Convegno Società Paleontologica Italiana*.

Müller P., 1984 – Decapod Crustacea of the Badenian. *Institutum Geologicum Hugaricum. Geologia Hungarica, Series Palaeontologica*, Budapest, 42: 1-317.

Müller P., 1993 – Neogene Decapod Crustaceans from Catalonia. *Scripta Museum Seminario Barcinonensis*, Barcelona, 225: 1-39.

Parona C. F., 1886 – Valsesia e Lago d'Orta. *Tipografia Bernardoni di Rebeschini e C.*, Milano.

Ristori G., 1886 – I Crostacei brachiuri e anomuri del Pliocene italiano. *Bollettino Società Geologica Italiana*, Roma, 5: 93-130.

Ristori G., 1889 – I Crostacei Piemontesi del Miocene inferiore. *Bollettino Società Geologica Italiana*, Roma, 7: 397-413.

Ristori G., 1891a – Contributo alla fauna Carcinologica del Pliocene Italiano. *Atti Società Toscana Scienze Naturali*, Memorie, Pisa, 11: 3-18.

Ristori G., 1891b – I Crostacei fossili di Monte Mario. *Atti Società Toscana Scienze Naturali*, Pisa, Memorie, 11: 19-29.

Sacco F., 1888 – I terreni terziari e quaternari del Biellese. Sezione biellese del C.A.I.

Sacco F., 1889-1890 – Il bacino terziario e quaternario del Piemonte. *Tipografia Bernardoni*, Milano.

Sacco F., 1890-1904 – I Molluschi dei terreni terziari del Piemonte e della Liguria. *C. Clausen Editore*: 7-30.

Sacco F., 1922 – Carta Geologica d'Italia alla scala 1:100.000. Foglio 69-Asti. 1° ed., Roma.

Sismonda A., 1839 – Notizie intorno a due fossili trovati nei Colli di San Stefano Roero. *Memorie Reale Accademia Scienze Torino*, Torino, ser. 2, 1: 90-95.

Sismonda E., 1846 – Descrizione dei Pesci e dei Crostacei fossili nel Piemonte. *Memorie Reale Accademia Scienze Torino*, Torino, ser. 2, 10: 1-89.

Sismonda E., 1861 – Appendice alla descrizione dei Pesci e dei Crostacei fossili nel Piemonte. *Memorie Reale Accademia Scienze Torino*, Torino, ser. 2, 19: 1-24.

Sturani C., 1978 – Messinian facies in the Piedmont basin. In: Messinian Evaporites in the Mediterranean. *Memorie Società Geologica Italiana*, Roma, 16 (1976): 11-25.

Sturani C. & Sampò M., 1973 – Il Messiniano inferiore in facies diatomitica nel bacino terziario piemontese. *Memorie Società Geologica Italiana*, Roma, 12: 335-358.

Tucker A.B., 1998 – Systematics of the Raninidae (Crustacea: Decapoda: Brachyura), with accounts of three new genera and two new species. *Proceedings Biological Society Washington*, Washington, 11 (2): 320-371.

Zuffardi Comerci R., 1929 – La fauna pliocenica di Masserano-Cossato (Biellese). *Atti Reale Accademia Scienze Torino*, Torino, 64: 305-313.

Wright C.W. & Collins J.S.H., 1972 – British Cretaceous crabs. *Palaeontological Society London,* London, 126: 1-114.

Ricevuto: 22 luglio 2004
Approvato: 3 settembre 2004